the investigation of glacial phenomena both present and past. In connection with the latter especial attention should be paid to evidences of glaciation on the highest peaks and to the outermost points of land. Also attention should be paid to evidences of past subsidence or elevation of the coast. Other branches of science, however, should not be ignored. The make-up of each party should be about as follows: a glacialist, as director in charge; a general geologist; a zoologist; a botanist; a meteorologist and an ethnologist. If possible, a physician should be obtained for each party, who could also act in one of the above capacities. So far as possible each member of a party should be a trained observer. In an expedition of this kind there should be no members that are not enthusiastic in the work, and each should be prepared to make the best of the opportunities offered in the necessarily limited time. The necessary expense, considering the circumstances, is not large, and it ought to be possible for each party to have sufficient funds to allow the director to select the other members.

Finally, although one summer's observations would amply repay the time spent and expense incurred, provision could be made to secure greater results through each party arranging to have its observations carried on by parties in succeeding seasons. It seems possible now that Greenland may be visited nearly every year by expeditions from the United States; certainly the six Peary expeditions have shown this to be practicable. In such case the return of a single member of a party to the position of the preceding year would enable a valuable series of observations to be made upon the edge of the inland ice and upon the motion of the glaciers by means of datum points established by the parties. Such datum points could be so located as to be found and used by one not a member of the original party.

The writer hopes to return himself to Greenland during the coming summer and continue the observations begun by the Boston party last summer.

A word may be necessary to call attention to the summer climate of Greenland. For camping during that season there is no serious exposure involved. The very long days with the sun above or only slightly below the horizon for the full twenty-four hours prevents the temperature ever becoming very low, and the continual daylight affords facilities for work or travel at all hours.

During the last summer the Boston party encountered no serious cold, the lowest recorded with a minimum thermometer being 26° above zero, F. As far as climate is concerned there is no reason why Greenland should not be a pleasant resort for the summer.

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Color-blindness and William Pole: A Study in Logic.

It has long been matter of common knowledge among psychologists that the color-sensations which persist, in the ordinary cases of partial color-blindness, are blue and *yellow*. This was a requisite consequence of Hering's theory and was predicted by him; it was *proved* by the first case of monocular color-blindness which was observed—that of v. Hippel in 1880—and this proof has been abundantly confirmed by the cases which have been discovered since. But the theory of Young and Helmholtz apparently required that, when two color-sensations only persisted, if one was blue the other must be either red or green. Now, the physicists (and most physiologists as well) too hastily took the Young-Helmholtz view as expressing fact and not theory, and they continued to infer (although Helmholtz himself had recognized the true state of the case) from the circumstance that the partially color-blind had two sensations only, that these sensations were, in the ordinary cases, blue and *red*, or blue and *green*; and in accordance with this deduction they classified most cases of color-blindness as red-blindness or green-blindness (without expressly stating that, in their view, in both cases, blindness to yellow was involved as well). There was absolutely no reason *except the theory* for affirming that the warm color of the defective person was either red or green; all that was known was that it occupied that portion of the spectrum which, for the normal

person, is occupied by red, yellow *and* green. Nevertheless, it is stated in twenty text-books that the sensations of the color-blind furnish exceedingly strong, if not convincing, evidence of the truth of the Young-Helmholtz theory. Moreover, the belief that the warm color is either red or green has become so ingrained that the cases by which it has been shown beyond question that it is in fact yellow have failed to produce any effect whatever. There is hardly a physicist, and there are very few physiologists, in the English-speaking world who do not still hold to this belief; as recent instances, we may cite the Century Dictionary and Johnson's Cyclopædia (both of which are, in general, of good authority in scientific matters), and the recent extensive memoir on color-blindness by Abney and Festing in the *Philosophical Transactions*. These last authors say that the examination of color-blind persons is of prime importance for testing any theory of color vision, and, nevertheless, they are content, like so many others, to *infer* the sensations of the color-blind from a theory which they have already adopted.

But as early as 1856 there was one man who, himself color-blind, had convinced himself that his own sensations were blue and yellow, and he should have convinced all the world as well if the world had been open to reason—if it had not been preoccupied with a theory. This man was William Pole, F. R. S., professor of civil engineering in University College. His papers on the subject were published in the *Philosophical Transactions;* his argument is exceedingly ingenious and it is little to the credit of the reasoning public that it did not make headway. Had it appeared a few years earlier than it did, it is probable that the Young-Helmholtz combination would never have been formed. Professor Pole preserves the interest in the theory of color visions which he felt forty years ago, and he is the one person, so far as I know, who has discussed Helmholtz's late profound mathematical contributions to the subject.

The history of opinion regarding color-blindness presents, therefore, this series of occurrences:

1. A deduction from a theory was taken for a fact.

2. That supposed fact was taken as confirming the theory.

3. The same supposed fact was held so strongly that the highly ingenious reasoning by which Professor William Pole showed it to be erroneous forty years ago failed to awaken attention.

4. Moreover, the cases of monocular color-blindness, by which it is absolutely contradicted, and which date from fifteen years ago, are without effect upon it, with most people, even at the present day.

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SCIENTIFIC LITERATURE.

Non-Euclidean Geometry, or The Science of Absolute Space. By JOHN BOLYAI. Translated from the Latin by DR. GEORGE BRUCE HALSTED. Austin, Texas, the Neomon.

This book of John Bolyai was published in an appendix to a work of his father's in 1832—within the memory of many men now living. The same date marks the publication of Faraday's experiments in the science of electricity, which revolutionized the whole theory of electricity and gave to the world the dynamo. Faraday's conception of electricity as an action that pervades all space like that of light and heat, and the later identification by Herz of all three phenomena as very probably different phases of one and the same action, is not more strange, new, or revolutionary, than Bolyai's science of absolute space. We are indebted for this English translation to the zeal, energy and ability of Dr. Halsted, who has long labored in this field of mathematics.

What is this science of absolute space? Those who wish to know in detail should get the book and read it carefully. The translator's introduction contains a complete historical summary, and the earlier portions of the work are within the comprehension of every student of elementary geometry. In general, Bolyai has shown that the geometry of Euclid is an hypothesis; that there are an infinite number of geometries equally probable with Euclid's, and that which of these coincides with the true properties of the space in which we live can be determined